APPENDIX E

JACKSON HOLE, WYOMING, ENVIRONMENTAL
RESTORATION PROJECT
SECTION 404(b)(1) EVALUATION
(40 CFR 230 - dated December 24, 1980)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLES

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1. PROJECT DESCRIPTION.

a. Location.

The proposed environmental restoration project would occur at four locations: Areas 1, 4, 9, and 10, near the towns of Wilson and Jackson in Teton County, Wyoming. Area 1 is located in Sections 13, 14, 23, and 24, Township 40 N., Range 117 W; Area 4 is located in Sections 2, 3, 10, and 11, Township 40 N., Range 117 W; Area 9 is located in Sections 13 and 24, Township 41 N., Range 117 W; and Area 10 is located in Sections 5, 6, and 7, Township 41 N., Range 117 W. (Refer to plate 1.)

b. General Description.

The U.S. Army Corps of Engineers (Corps) plans to restore wetland and riparian habitats in the Snake River in response to environmental resource impacts resulting from levees constructed along the Snake River at Jackson, Wyoming. Over time, the levees have significantly changed the physical character of the river system and contributed to the loss of environmental resources. The presence of the levees has reduced the size of the actual floodplain resulting in a degraded condition of the area between the levees. Most notable effects include changes in channel configuration, which have eliminated natural braiding and reduced the number and size of islands. Associated with this change is the constriction of the floodplain and concentration of flow between the levees, resulting in higher velocities through the area. The high-velocity flows erode the river bottom gravels, islands, and vegetation along the banks. Aquatic habitat effects include loss of spawning area for the Snake River fine-spotted cutthroat trout, difficult passage to spring creeks for fish spawning, and loss of low-energy resting habitat for fish. Wildlife habitat effects include loss of shrub-willow cottonwood riparian areas used by moose, elk, mule deer, furbearers, numerous small mammals, and various other wildlife species.

The proposed project would employ a variety of tools aimed at protecting and improving habitat in and along the designated stretch of the Snake River. The project would involve construction of channel stabilization pools, secondary channels, off-channel pools, eco fences (both rock and piling), spur dikes (bank barbs and kickers), rock grade control structures, and anchored root wad logs.

Cumulatively, the tools would involve temporary and permanent discharges of dredged material and permanent discharges of riprap.

Gravel removal would be used to increase channel capacity, and construct off-channel pools, secondary channels leading to and from the off-channel pools, and channel stabilization pools. These tools are intended to maintain channel stability, improve sediment transport, and diversify fish habitat. Gravel removal to increase channel capacity would compensate for discharges of dredged and fill material, thereby, ensuring the base flood flow capacity is maintained.

Eco fences would be employed to protect existing islands from erosion and to rebuild islands through deposition. Spur dikes would be placed to slow bank erosion and create in-water fish habitat. Rock grade control structures would be used to prevent erosion and protect existing riparian and aquatic habitat. Anchored root wad logs would also be used to protect existing islands and promote deposition in an attempt to restore eroded islands.

The shifting nature of the braided river is expected to have some effect upon the structures. The extent of effects would vary between structures and from site to site, depending upon river conditions. Some structures would likely require maintenance to ensure they continue to function as designed. The frequency of maintenance would be dictated by the extent of river effects upon the structures. Completed structures would be monitored to identify effects of river flows and the need for maintenance. Monitoring procedures for structure integrity and function and aquatic and terrestrial habitat changes would be contained in a monitoring plan that would be developed by the Corps prior to implementation of the project. Maintenance would likely be necessary for channel stabilization pools, secondary channels, off-channel pools, eco fences, and spur dikes. Typical maintenance activities might include: removal of gravel from off-channel pools and the upper end of secondary channels leading to the off-channel pools, removal of gravel from channel stabilization pools, measures to reset piles and reattach cables on piling eco fences, and the addition of large rock to rebuild eroded spur dikes. The quantity of materials necessary that perform maintenance to the various structures would depend upon the extent to which maintenance may be needed. Any discharges necessary to conduct maintenance would be consistent with the materials, methods, and disposal sites identified in the Jackson Hole, Wyoming, Environmental Restoration Project, Environmental Assessment, and this 404(b)(1) evaluation.

c. Purpose.

The purpose of the project is to restore fish and wildlife habitat that was lost as a result of construction, operation, and maintenance of the Jackson Hole Flood Control Project, including levees constructed by non-Federal interests. The project is intended to preserve and enhance remaining terrestrial and aquatic habitat and replace portions of habitat lost due to the effects of the levees upon the river system.

d. Description of Method for Dredging and Placement of Materials.

(1) General Description.

Gravel would be removed to compensate for reduction in channel capacity caused by discharges of fill material and deposition of sediments around the completed structures. Gravel removal would also be necessary in the construction of channel stabilization pools, off-channel pools, secondary channels, eco fences, rock grade control, and spur dikes. Riprap fill material would be used to construct eco fences, spur dikes, and rock grade control.

All work would be accomplished in a manner that would comply with Quality Standards for Wyoming Surface Waters and all terms and conditions detailed in the Federal Water Pollution Control Act §401 Certification from Wyoming Department of Environmental Quality, if issued. The Snake River is classified as Class 1 upstream of the Wyoming Highway 22 bridge. Areas 9 and 10 fall within this reach. Areas 1 and 4 are downstream of the bridge and fall within Class 2 surface waters. Classes 1 and 2 water carries basically the same water quality standards for protection of aquatic life. The standards most pertinent to this project require that turbidity increases downstream from the activity shall not exceed 10 Nephelometric Turbidity Units (NTU's) above background (upstream) levels. Currently, the standards do not allow for short-term increases in turbidity above this level. However, proposed changes to the regulations include allowance for short-term increases of turbidity made on a case-by-case basis. There is also a requirement for zone of passage, or a continuous water route that joins segments of a surface water body above and below a mixing zone. Such routes would be comprised of continuous flow with less than 10 NTU above background around the work site.

(a) Gravel Removal.

Gravel removal includes excavations to increase channel capacity and excavations to construct channel stabilization pools, off-channel pools and secondary channels. Gravel removal would be conducted either in the dry, above the level of the existing water surface flow, or within areas separated from surface flows by a temporary diversion or berm. Water diversion materials would be scooped from adjacent cobble, gravel, and sand deposits above the existing water surface flow and discharged to construct temporary diversion berms where needed to de-water excavation sites. Water diversion berms would specifically be used to alternately de-water channels at Area 9 north of the bridge to allow the channel capacity excavations to occur in non-flowing waters. Use of diversions at other locations would be dictated by site conditions that exist at excavation sites at the time of construction. Following completion of work within the de-watered areas, the berm material would be scooped and transported to a permitted gravel processing facility for disposal.

Gravel removal would be accomplished using a track-mounted excavator, rubber-tired backhoe, or other similar equipment, along with trucks to transport the material to disposal and stockpile sites. The 4-inch plus cobble would be screened from the removed gravel and permanently discharged as dredged material below the ordinary high water mark (OHWM) to rearmor the bottom of the channel capacity, channel stabilization pool, off-channel pool, and secondary channel gravel removal sites. The excavated cobble, gravel, and sand may be temporarily stockpiled in the dry below the OHWM in preparation for screening. The 4-inch plus screened cobble material may also be temporarily stockpiled below the OHWM in preparation for rearmoring the gravel removal sites. Temporary stockpile sites would be gravel deposit areas free of vegetation. Cobble, gravel, and sand that would not be screened, as well as any excess 4-inch plus cobble, would be transported by truck to a permitted gravel processing facility for disposal prior to anticipated high flows. The channel bottom of channel capacity excavations, channel stabilization pools, and secondary channels would be armored with the 4-inch plus cobble. During low-flow periods, armor material would be placed in rows spaced 10 feet apart on center, aligning perpendicular to the channel centerline. The rows would have a cross-sectional area equivalent to 10 square feet. This would provide a volume of armor equivalent to a 1-foot-thick layer of armor on the channel bottom. The bottom of off-channel pools would be armored at the upper ends of the channels with a layer of 4-inch plus cobble, approximately 12 inches thick.

(b) Secondary Channels.

Secondary channels would provide water to and from off-channel pools. Material would be scooped with an excavator and side-cast and spread onto adjacent, unvegetated gravel deposits as a permanent discharge of dredged material. The dredged material would be evenly spread over the gravel bar using the excavator. However, if dump truck access routes are available, which would have minimal disturbance upon vegetation, the material would be scooped and transported to a permitted gravel processing facility for disposal. Disposal on adjacent gravel deposits would be below the OHWM, in the dry and above the low flow of the river.

(c) Off-channel pools.

An excavator would scoop gravel from the pool site, side-cast and spread the material onto adjacent, unvegetated gravel deposits as a permanent discharge of dredged material. The dredged material would be evenly spread over the gravel bar. However, if dump truck access routes are available, which would have minimal disturbance upon vegetation, the material would be scooped and transported to a permitted gravel processing facility for disposal. Disposal on adjacent gravel deposits would be below the OHWM, in the dry and above the low flow of the river.

(d) Eco Fences.

Two different types of fences may be used: piling eco fences and rock eco fences. An excavator may remove and reposition cobbles and gravel to prepare the site for driving the piles. No discharges of fill material would occur in connection with the piling eco fences. Rock eco fences, constructed of riprap, would require repositioning of cobble, gravel, and sand to embed the structure into the channel bottom. Riprap would be trucked to the site and dumped directly into the excavated site.

(e) Bank Barbs.

Bank barbs would be built of riprap and would extend up to 30 feet into the river from the adjoining levee. Gravel and cobble excavated to embed the structure would be transported to a permitted gravel processing facility for disposal. Equipment used to excavate for the barbs and to place riprap would sit atop the levee and would maneuver onto the top of the barb when necessary.

(f) Kickers.

Kickers would be composed of riprap armor extending up to 60 feet from the adjoining levee. Gravel and cobble excavated to embed the kickers would be used as the random core fill material. Excavated material would be temporarily stockpiled out of the channel on the adjacent levee. The structure would be tied into the adjoining levee. Equipment used to excavate for the kickers and to place riprap would sit atop the levee and would maneuver onto the top of the kicker, when necessary.

(g) Rock Grade Control.

Existing cobble, gravel, and sand would be removed to a standard uniform depth of 3 feet below the ground surface by an excavator. The material would be scooped and transported off-site to a gravel processing facility for disposal. The area would then be graded and filled with riprap to match existing topography. Riprap would be transported to the site by truck, dumped, and spread using an excavator to achieve uniform depth. Material would be placed below the OHWM, in the dry, and above the level of existing water flows.

(h) Anchored Root Wad Logs.

Root wad logs would be obtained from along the river channel within the four project areas. Equipment would be used to either transport or drag the logs to the installation site. Root wad logs that must be transported across low-flow channels would be dragged across using a cable winch. Minor repositioning of cobble, gravel, and sand may be required to partially embed root wad logs into the channel bottom.

e. Description of the Proposed Discharge Site.

(1) Location.

The locations of project Areas 1, 4, 9, and 10 are identified in paragraph 1.a. above and on plate 1.

(a) Gravel Removal.

Discharges of dredged 4-inch plus cobble would occur upon the disturbed bottom surface of the channel capacity and channel stabilization pool excavation sites. Any excavated cobble, gravel, and sand temporarily stockpiled in preparation for screening, and temporarily stockpiled screened cobble, would be placed above the existing water level, in the dry, upon adjacent gravel deposits. Excavated material that would not be screened would be transported from the channel and disposed at a permitted gravel processing facility in uplands.

(b) Secondary Channels.

Dredged cobble, gravel, and sand would either be permanently side-cast on adjacent, unvegetated gravel deposits or transported to a permitted gravel processing facility in uplands for disposal.

(c) Off-channel Pools.

Dredged cobble, gravel, and sand would either be permanently side-cast on adjacent, unvegetated gravel deposits or transported to a permitted gravel processing facility in uplands for disposal.

(d) Eco Fences.

Discharges of dredged material would occur when the cobble, gravel, and sand is smoothed, leveled, or repositioned to facilitate placement of both rock and piling eco fences. Gravel would be moved only as necessary to partially embed the eco fences into the river bottom. The minor amount of removed material would be side-cast and spread around and adjacent to the structures as a permanent discharge of dredged material.

(e) Bank Barbs.

Dredged cobble, gravel, and sand may be temporarily stockpiled on the adjacent levee, above the OHWM. The dredged material would be transported to a permitted gravel processing facility for upland disposal. Riprap fill material would be placed below the OHWM on the bottom of the disturbed excavation site.

(f) Kickers.

Dredged cobble, gravel, and sand would be temporarily stockpiled on the adjacent levee, above the OHWM. Permanent discharges of the dredged cobble, gravel, and sand would occur below the OHWM as core material for each kicker. Riprap fill material would be placed below the OHWM on the bottom of the disturbed excavation site.

(g) Rock Grade Control.

Dredged cobble, gravel, and sand would be transported to a permitted gravel processing facility upland for disposal. Riprap fill material would be placed below the OHWM on the bottom of the disturbed excavation site. Rock grade control to be constructed in Area 9 only, based on current river conditions.

(h) Anchored Root Wad Logs.

Permanent discharges of dredged material would occur when the cobble, gravel, and sand is smoothed, leveled, or repositioned to facilitate anchoring of root wad logs. Gravel would be repositioned only as necessary to partially embed the root wad logs into the gravel deposits.

(2) Type of Site.

Areas 1, 4, 9, and 10 all consist of a cobble, gravel, and sand substrate. All work affecting the substrate would occur in the dry with the exception of the discharge of dredged material to construct temporary water diversions, excavations, and discharges of dredged and fill material to construct spur dikes, and discharge of dredged 4-inch plus cobble to armor certain excavation sites. Spur dike and water diversion construction would occur in the flowing portion of the low-flow stream. Excavation sites to be armored with 4-inch plus cobble would likely contain water that would have infiltrated through the cobble, gravel, and sand substrate. The water would be separated from surface flows of the low-flow stream by construction of a temporary water diversion.

(3) Type of Habitat.

The Snake River has two separate classifications as a surface water of the State of Wyoming. The portion of the river upstream of the Wyoming Highway 22 bridge (which includes Areas 9 and 10) is classified as a Class 1 water. That portion of the river downstream of the bridge, which includes Areas 1 and 4, is Class 2 water.

Water quality in the upper Snake River and its tributaries is generally high most of the year. Data reported in the 1996 and 1997, U.S. Geological Service (USGS) Water Resources Data, Idaho, Volume 1, show that at the Snake River at Moose, Wyoming, gage site maximum water temperatures usually remain below 60.8 °F; pH generally ranges in value from 7.8 to 8.4; dissolved oxygen saturation is always near 100 percent; specific conductance ranges from 100 to 200 micro Siemens per centimeter (μS/cm); nitrate nitrogen is generally below 0.12 parts per million (ppm) as nitrogen (N); ammonia nitrogen below 0.08 ppm as N; orthophosphorous is generally below 0.020 ppm as phosphorus (P); and total phosphorous concentrations are usually less than 0.20 ppm as P. Measured suspended sediment concentrations are less than 30 mg/l during low-flow periods. Turbidity is generally the greatest water quality problem and increases with high runoff. Sources of turbidity at high flows are generally erosion from surface runoff and tributaries. Jackson Lake influences the channel regime in the upper part of the river by removing all but the finest suspended sediment from the water. All of the bedload in the lower river is derived from tributary streams and from erosion of the channel and channel banks downstream of Jackson Lake.

(4) Timing and Duration of Discharge.

Construction of the project would begin in August 2001 and continue into 2004. Construction would occur at only one of the four sites each year. Discharges of dredged and fill material would occur during low river flows. Low-flow periods generally occur from October 15 until March 15.

f. General Description of Dredged or Fill Material.

(1) General Characteristic of Material.

(a) Dredged Material.

Materials to be excavated at Areas 1, 4, and 10 are generally composed of a cobble layer on the surface, underlain by poorly graded gravel with sand. Area 9 consists of the same cobble layer; however, it is underlain by a well-graded gravel with sand. The cobble layer at all four areas is approximately 12 inches thick with a maximum particle size of 12 inches.

(b) Discharges of Dredged Material.

Both temporary and permanent discharges of dredged cobble, gravel, and sand would occur below the OHWM. In addition, permanent discharges of 4-inch plus cobble dry screened from dredged cobble, gravel, and sand would also occur below the OHWM.

(c) Fill Material.

Permanent discharges of fill material would consist of riprap and root wad logs. Riprap would be clean angular rock, free of fines, with an average diameter of 2 feet. Root wad logs would consist of irregular shaped tree trunks with the root wad attached. A minor amount of soil may still be attached to the root wad.

(d) Discharges of Fill Material.

Riprap fill would be used to construct rock eco fences, spur dikes, and rock grade control structures.

(2) Quantity of Material and Size of Excavation and Discharge Areas.

Multiple numbers of structures and varying amounts of excavation and discharges would occur within each of the four project areas. The quantities identified below represent approximate maximum quantities. Actual quantities could exceed the estimates, but are most likely to be less than the maximum identified.

(a) Gravel Removal to Construct Channel Stabilization Pools and Maintain Channel Capacity.

Gravel would be removed to construct channel stabilization pools and to maintain channel capacity within the 100-year event base flood capacity. The 4-inch plus cobble would be screened from the removed gravel and permanently discharged as dredged material below the OHWM to rearmor the bottom of the channel capacity and channel stabilization pool gravel removal sites.

The excavated cobble, gravel, and sand may be temporarily stockpiled below the OHWM in preparation for screening. The 4-inch plus cobble screened material may also be temporarily stockpiled below the OHWM in preparation for rearmoring the bottom of the channel stabilization pools and channel capacity excavation sites. Temporary stockpile sites would be gravel deposit areas free of vegetation and above the elevation of the flowing water. Cobble, gravel, and sand not screened would be transported by truck to a permitted gravel processing facility for disposal. Refer to tables E-1 and E-2 for excavation quantities and size of areas.

Table E-1. Channel Capacity Excavation and Channel Stabilization Pools. Gravel Removal Quantities and Size of Areas.

	Area 1	Area 4	Area 9	Area 10
Channel Capacity Excavation	37,000 cy[1/]	128,800 cy	130,000 cy	9,630 cy
	16 acres	17.4 acres	31.0 acres	1.5 acres
Channel stabilization pool Excavation	97,000 cy	429,600 cy	0 cy	272,000 cy
	19 acres	33.1 acres	0 acres	19 acres

[1/] Cubic yards.

Table E-2. The 4-Inch Plus Cobble to Armor Channel Stabilization Pools and Channel Capacity Excavation Sites. Discharge Quantities and Size of Areas.

	Area 1	Area 4	Area 9	Area 10
Channel Capacity Excavation	7,350 cy	25,760 cy	26,000 cy	1,926 cy
	16 acres	17.4 acres	31.0 acres	1.5 acres
Channel stabilization pool	19,400 cy	85,920 cy	0 cy	54,400 cy
	19 acres	33.1 acres	0 acres	19 acres

(b) Secondary Channels.

Cobble, gravel, and sand would be excavated to enhance or construct secondary channels. This material would be side-cast and spread onto adjacent, unvegetated gravel deposits as a permanent discharge of dredged material. However, if dump truck access routes are available that would have minimal disturbance upon vegetation, the material would be scooped and transported to a permitted gravel processing facility for disposal. Refer to tables E-3 and E-4 for quantities and size of area.

Table E-3. Secondary Channels. Excavation Quantities and Size of Areas.

	Area 1	Area 4	Area 9	Area 10
Excavation to Construct Secondary Channels	700 cy	1,120 cy	500 cy	0 cy
	0.14 acre	0.23 acre	0.1 acre	0 acres

Table E-4. Secondary Channels. Discharge Quantities and Size of Areas of 4-Inch Plus Cobble to Armor Secondary Channels.

	Area 1	**Area 4**	**Area 9**	**Area 10**
Discharge of 4-inch Plus Cobble	140 cy	0 cy	100 cy	0 cy
	0.14 acre	0 acres	0.1 acre	0 acres

(c) Off-Channel Pools.

Cobble, gravel, and sand would be excavated to enhance or construct off-channel pools. This dredged material would be side-cast and spread onto adjacent, unvegetated gravel deposits as a permanent discharge of dredged material. However, if dump truck access routes are available that would have minimal disturbance upon vegetation, the material would be scooped and transported to a permitted gravel processing facility for disposal. Refer to tables E-5 and E-6 for quantities and size of areas.

Table E-5. Off-Channel Pools. Excavation Quantities and Size of Areas.

	Area 1	**Area 4**	**Area 9**	**Area 10**
Excavation to Construct Pools	48,000 cy	32,000 cy	0 cy	12,000 cy
	9.9 acres	5 acres	0 acres	2.5 acres

Table E-6. Off-Channel Pools. Discharge Quantities and Size of Areas of 4-inch Plus Cobble to Armor Off-Channel Pools.

	Area 1	**Area 4**	**Area 9**	**Area 10**
Discharge of 4-Inch Plus Cobble	9,600 cy	6,400 cy	0 cy	2,400 cy
	9.9 acres	5 acres	0 acres	2.5 acres

(d) Eco Fences.

The quantity of gravel removal necessary to embed eco fences into the gravel deposits would depend upon the site selected for placement of the structure. Gravel would be moved only as necessary to embed eco fences into the river bottom or create an area for driving piles. The removed material would be temporarily stockpiled adjacent to the excavation site and subsequently used to permanently embed the completed structures. No discharges of fill material are necessary for construction of pile supported eco fences. Refer to table E-7 for quantities and size of areas.

Table E-7. Eco Fences. Excavation and Discharge Quantities and Size of Areas. Numbers Shown under Each Type of Eco Fence Represent the Combined Quantity and Combined Size of All Structures in that Category.

	Area 1		Area 4		Area 9		Area 10	
Type of Eco fence	Piling Fence	Rock Fence	Piling Fence	Rock Fence	Piling Fence	Rock Fence	Piling Fence	Rock Fence
Excavation to Embed Structure	1,700 cy	5,450 cy	28,330 cy	9,241 cy	250 cy	670 cy	1,800 cy	5,860 cy
	3,660 ft[1/]	3,660 ft	6,210 ft	6,210 ft	430 ft	430 ft	3,930 ft	3,930 ft
Discharge of Dredged/ Excavated material	1,700 cy	5,450 cy	28,330 cy	9,241 cy	250 cy	670 cy	1,800 cy	5,860 cy
	3,660 ft	3,660 ft	6,210 ft	6,210 ft	430 ft	430 ft	3,930 ft	3,930 ft
Discharge of riprap	0 cy	7,100 cy	0 cy	12,065 cy	0 cy	850 cy	0 cy	7,650 cy
	0 ft	3,660 ft	0 ft	6,210 ft	0 ft	430 ft	0 ft	3,930 ft

[1/] Feet.

(e) Bank Barbs.

Cobble, gravel, and sand would be excavated to embed bank barbs into the riverbed. The material would be temporarily stockpiled on the adjacent levee, above the OHWM. This material would be transported to a permitted gravel processing facility for upland disposal. Riprap fill material would be permanently discharged below the OHWM to construct bank barbs. Refer to table E-8 for quantities and size of areas.

Table E-8. Bank Barbs. Excavation and Discharge Quantities and Size of Areas.

	Area 1	Area 4	Area 9	Area 10
Excavation to Embed Bank Barbs	0 cy	100 cy (combined total for 5 structures)	140 cy (combined total for 7 structures)	240 cy (combined total for 12 structures)
	0 acres	0.1 acre	0.1 acre	0.3 acre
Discharge of Riprap	0 cy	200 cy (combined total for 5 structures)	280 cy (combined total for 7 structures)	480 cy (combined total for 12 structures)
	0 acres	0.1 acre	0.1 acre	0.3 acre

(f) Kickers.

Cobble, gravel, and sand would be removed to embed kickers into the river bottom. The material would be temporarily stockpiled on the adjacent levee, above the OHWM. This dredged material would be permanently discharged back into the river as core material for kickers. Riprap fill material would be permanently discharged below the OHWM to construct kickers. Refer to table E-9 for quantities and size of areas.

Table E-9. Kickers. Excavation and Discharge Quantities and Size of Areas.

	Area 1	**Area 4**	**Area 9**	**Area 10**
Excavation to Embed Kickers	0 cy	1,000 cy (combined total for 5 structures)	1,600 cy (combined total for 8 structures)	2,600 cy (combined total for 13 structures)
	0 acres	0.4 acre	0.6 acre	1 acre
Dredged Material Discharge	0 cy	1,000 cy (combined total for 5 structures)	1,600 cy (combined total for 8 structures)	2,600 cy (combined total for 13 structures)
	0 acres	0.4 acre	0.6 acre	1 acre
Discharge of Riprap	0 cy	750 cy (combined total for 5 structures)	1,200 cy (combined total for 8 structures)	1,950 cy (combined total for 13 structures)
	0 acres	0.4 acre	0.6 acre	1 acre

(g) Rock Grade Control.

Rock grade control would be constructed in Area 9 only, based on current river conditions. Prior to the start of construction, river conditions may create new areas that warrant rock grade control. Approximately 3,500 cy of cobble, gravel and sand would be excavated to embed riprap into the river bottom to construct rock grade control at Area 9. This material would be scooped and transported to a permitted gravel processing facility in uplands for disposal. Approximately 3,500 cy of riprap fill material would be permanently discharged below the OHWM. Rock grade control would encompass approximately 0.7 acres at Area 9.

(h) Anchored Root Wad Logs.

The quantity of gravel removal necessary to position and anchor root wad logs in the gravel bed would depend upon the site selected for placement of the structure. The quantity is expected to be minimal. Gravel would be moved only as necessary to position and partially embed the root wad logs. No discharges of fill material are necessary for placement of anchored root wad logs.

(3) Source of Material.

The Snake River is the source of cobble, gravel and sand that would make up the permanent and temporary discharges of dredged material. Riprap fill would be obtained from an upland site to be selected by the construction contractor. Root wad logs would be obtained from the existing assortment of downed woody debris located within the four project areas. If needed, additional root wad logs may be obtained commercially from Walton Quarry, located near Area 9 or Jackson Lake.

2. FACTUAL DETERMINATIONS.

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope.

In 1996, the active channel substrate elevation in Area 1 is approximately 6,000 feet National Geodetic Vertical Datum (NGVD) of 1929 and channel slope was 14.4 feet per mile. Area 4 has an approximate elevation of 6,075 feet NGVD and slope of 8.4 feet per mile. The Area 9 approximate elevation is 6,160 feet NGVD with a slope of 18.2 feet per mile. Area 10 elevation is approximately 6,240 feet NGVD and slope is about 19.8 feet per mile.

(2) Substrate Particle Size.

Surface materials vary widely from sandy silt to large 6- to 10-inch cobble with the largest materials generally located in the active channel bottoms, finer materials located in protected areas downstream of vegetation or debris, and areas distant from the main channel.

Underneath the surface layer, which may range from 6 to 12 inches, the material consists of a much more uniformly distributed mix of sand through cobble sizes. The 4-inch plus cobble make up about 5 percent of the subsurface materials in Areas 1 and 4 and about 15 percent to 18 percent of the subsurface materials in Areas 9 and 10 (based on samples collected at each site).

(3) Dredged/Fill Material Movement.

The project sites are in a reach of the Snake River that is highly unstable. Though the measures proposed are meant to improve stability, the inherent nature of high velocity-streams would result in some displacement of materials placed during construction. Cobbles placed to provide streambed armor in channel capacity excavation areas would be redistributed over the bottom surface by high flows. Materials that may be side-cast onto dry gravel bars during construction of channel stabilization pools, off-channel pools, and secondary channels would likely move when river flows are high enough to influences those areas. The rock grade control is intended not to move but to prevent erosion or down-cutting of the channel. However, the riprap material placed there may move until it settles. Anchored root wad logs, rock eco fences, and piling eco fences are intended to be relatively permanent fixtures. As with the other project techniques, they would be monitored for movement. Bank barbs and kickers are expected to experience some erosion by impingement by high-velocity flows. Due to the large angular nature of the riprap material, which would be used to construct them, it is not likely that the fill material would move very far.

(4) Physical Effects on Benthos.

Excavations for channel capacity, off-channel pools, channel stabilization pools, secondary channels, rock eco fences, rock grade control, and spur dike kickers could affect the benthos, by removing and/or destroying them. Benthos could also be affected by discharges of dredged material placed back into the channel capacity, side pool, and channel stabilization pool excavation sites (although these areas will have just been disturbed). Discharges of cobble, gravel and sand resulting from off-channel pool and secondary channel excavations may also affect benthos (although this material may be spread on the adjacent gravel bars above the low flow of the channel, and discharges of riprap to construct spur dikes and eco fences). The benthos impact would be somewhat reduced due to the ability of some benthic invertebrates to migrate with the water. There would likely be a lot of invertebrate drift downstream to nonimpacted areas. Recolonization of disturbed areas is expected to occur soon after disturbance, whenever the first flows begin over those areas. In areas where measures would be taken to increase sedimentation rates (*e.g.*, downstream of eco fences along island shorelines) sedimentation rates are expected to be slow enough to allow escape of macro-invertebrates.

(5) Other Effects.

No other effects are anticipated.

(6) Actions Taken to Minimize Impacts.

A Corps biologist would be on-site to coordinate with the contractor. All in-water work would be conducted during low-water flows in the Snake River. Low water generally occurs from approximately October through April.

b. Chemical Description of Materials.

Due to the coarse nature of all dredge and fill materials, which would be handled during this project, no chemical analyses have been performed. A Tier 1 evaluation indicated no need for further assessment of contaminants in the substrate. However, low concentrations of dissolved atrazine (0.005 μg/l and less) were reported in water sampled in 1996 and 1997 by the USGS at the Snake River at Moose, Wyoming, Station (USGS Water-Data Report ID-96-1 and ID-97-1). There is no reason to believe that the sediments contain any chemicals in concentrations of concern. The fill material that would be brought in (riprap) would be free of chemical contaminants.

c. Water Salinity, Circulation, and Fluctuation Determinations.

(1) Water.

(a) Salinity.

No effect.

(b) Water Chemistry.

Slight decreases in dissolved oxygen may occur during in-water work periods, but the spatial extent would be small and duration would be short. Compliance with Wyoming Surface Water Quality Standards would result in only acceptable changes in water quality. No discharges of chemicals are proposed as part of this project.

(c) Clarity.

In-water work would result in increases in suspended sediments in the water column. A turbidity monitoring program would be implemented during any in-water construction activities. Restricting decreases in water clarity by limiting increases in turbidity to no more than 10 NTU's above background would ensure that visible plumes of water, with lessened clarity, do not extend far downstream and are short lived. When the river is returned to flow over an excavated area, there would be an initial increase in turbidity as the flow picks up the fine material from the surface. This should be of very short duration, perhaps a few hours.

(d) Color.

Changes in water color that result from discharges of dredged or fill material would be linked to changes in water clarity and would be short lived.

(e) Odor.

No effect.

(f) Taste.

There are no known municipal or private potable water supply intakes immediately downstream of the four project areas; thus taste is not a relevant factor.

(g) Dissolved Gas Levels.

The project is not expected to have a substantial effect on total dissolved concentrations. Small, short-lived dissolved oxygen reductions could result in very minor reductions in total dissolved gas pressures.

(h) Nutrients.

Disturbance of sediments during in-water excavations and dissolution during in-water disposal may increase water column concentrations of inorganic and organic nutrients. Rapid dilution would occur. Excavations and discharges in the dry would have no impact upon nutrients.

(i) Eutrophication.

Creation of low-velocity habitat may result in increased biological productivity in those areas. This would be a desirable effect of this project. No negative eutrophication effects are expected.

(j) Others.

As off-channel pools are constructed, the temperature of any standing water that becomes exposed would increase with exposure to warm air temperatures and daylight. However, because these areas should be devoid of susceptible macroorganisms due to lack of connection with flowing water and prior desiccation, there should be no effect. Water from these pools would mix with cooler water from supply channels before entering the river.

(2) Current Patterns and Circulation.

(a) Current Pattern and Flow.

The project is designed to provide marked beneficial effects by changing flow patterns, depths, and velocities without impeding flows. No negative impacts are expected.

(b) Velocity.

No negative impacts are expected. Localized velocity decreases are expected. Positive impacts may occur if structures slow velocities sufficiently to allow deposition of a layer of soil and subsequent establishment of vegetation.

(c) Stratification.

No effect.

(d) Hydrologic Regime.

The project would not effect the normal river flows through the sites.

(3) Normal Water Fluctuations.

Normal water level fluctuations are affected by levees located throughout this stretch of the Snake River. It is assumed that the current situation represents the normal fluctuations. Velocities are increased through this stretch because of the levees. Because channel capacity excavations would compensate for discharges and deposition, the project should have minimal effect upon normal water fluctuations. No water would be taken out or added to the river due to the project. However, modifications to the streambed would influence the frequency and duration of cobble bar inundation and saturation in affected areas.

(4) Actions that will be Taken to Minimize Impacts.

No further actions will be necessary.

d. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Site.

Test samples of the substrate in this reach of the river revealed less than 2 percent of the sediment to be very fine sand or smaller fines. Turbidity would be monitored and work modified to comply with water quality standards. Any effects that may result should be localized and dissipated rapidly; therefore, no significant reduction in primary productivity should occur.

(2) Effects (Degree and Duration) on Chemical and Physical Properties of the Water Column.

(a) Light Penetration.

Any increased turbidity occurring as a result of the proposed action would cause short-term reduction in light penetration. However, due to the anticipated limited effects upon the water column, effects on chemical and physical properties would be minor to negligible and short-lived. Also, any increases in turbidity above the standard would result in work stoppage until the turbidity returns to background levels. Due to the limited presence of fines in the river, little reduction in light penetration due to increased turbidity is expected.

(b) Dissolved Oxygen.

Slight reductions in dissolved oxygen concentrations may occur due to decomposition of resuspended organic matter but will be short lived.

(c) Toxic Metals and Organics.

The materials to be moved are relatively coarse in nature, therefore, should not contain contaminants. In addition, there are no known sources of contaminants in the area.

(d) Pathogens.

No effect.

(e) Aesthetics.

A minor turbidity plume would likely occur in the low-flow channel during in-water work. This plume is expected to be noticeable only during construction and should only extend a short distance downstream before dissipating. Effects of the increased turbidity are expected to be minor due to monitoring and modification of work in compliance with water quality standards. Turbidity increases lasting for a short time can be expected when flows first pass over areas that have been worked in the dry.

(f) Other.

No other effects.

(3) Effects on Biota.

(a) Primary Production, Photosynthesis.

Due to the limited presence of fines in the river, little reduction in light penetration due to increased turbidity is expected. Any effects that may result should be localized and dissipated rapidly, therefore, no significant reduction in primary productivity should occur. Increases in primary productivity may be expected in areas where low velocity habitat is enhanced (*e.g.,* off-channel pools, channel stabilization pools, and spur dikes).

(b) Suspension/Filter Feeders.

Prey and predators displaced from the work areas would find similar suitable habitat in the immediate vicinity of the disturbance. Invertebrate drift would increase from in-water work areas, enhancing downstream foraging during construction. Recolonization would occur rapidly. Zones of passage required around mixing zones to comply with water quality standards would be provided.

(c) Sight Feeders.

Sight feeding could be impacted within the turbidity plumes immediately downstream of in-water work. However, plumes of reduced water clarity would rapidly dissipate so impacts are expected to be minimal.

(4) Actions Taken to Minimize Impacts.

No further actions will be necessary.

e. Contaminant Determinations.

(1) Due to the coarse nature of the dredged and fill materials to be handled during this project, no direct contaminant analyses are required. There is no reason to believe that the substrate contains sufficient levels of chemical contaminants to cause concern.

f. Aquatic Ecosystem and Organism Determinations.

(1) Plankton Effect.

No effect.

(2) Benthos Effects.

Benthic communities in the construction area would be disturbed, buried, and/or destroyed. Upon completion of the project, adjacent benthic communities should colonize excavation sites and sites of discharged dredged and fill material.

(3) Nekton Effects.

Mobile aquatic organisms would likely move out of the immediate area of the proposed in-water work, but would return upon completion of the proposed actions.

(4) Aquatic Food Web Effects.

Disturbance and destruction of benthic communities at the proposed sites due to disturbances created by the project would cause local reduction in the available food supply to higher organisms resident to the sites. This would displace these resident populations to surrounding water until the food chain is reestablished. The benthic recolonization time period, and its impact upon the sites total food web should be negligible due to the limited scope of in-water work.

(5) Special Aquatic Site Effects.

(a) Sanctuaries and Refuges.

The National Elk Refuge is located approximately 3 miles east of the four project areas and Wyoming Game and Fish Department's South Park Habitat Unit is located east of Area 1. The project is not expected to have any effect upon sanctuaries and refuges.

(b) Wetlands.

Wetlands would not be adversely affected by excavation, discharges of dredged, or fill material, or equipment access. All work would occur in unvegetated cobble, gravel, and sand depositional areas located below the OHWM of the Snake River. The project would provide long-term potential for wetland establishment in areas of deposition downstream of anchored root wad logs and some eco fences. Silts deposited below these structures would provide suitable seedbed sites for natural vegetation regeneration. Off-channel pools would also provide opportunity for wetland establishment.

(c) Mud Flats.

Not applicable.

(d) Vegetated Shallows.

Not applicable.

(e) Riffle and Pool Complexes.

Kickers would create pools soon after they are installed. Anchored root wads have the potential to create additional pool areas depending on the channel migration pattern. Protection of existing vegetated islands may also provide more pool habitat over time by slowly releasing woody debris instead of many trees being washed away in one high-water event. Trees that fall into the river can be an important element of quality pools. The proposed project may cause an increase in the pool-to-riffle ratio of the project areas.

(6) Threatened and Endangered Species.

A Biological Assessment (BA) was prepared for the proposed action. In response to the BA, the U.S. Fish and Wildlife Service responded that the project may affect, but would not likely adversely affect, the bald eagle, peregrine falcon, whooping crane, grizzly bear, and gray wolf.

(7) Aquatic Life Forms.

The effects of the proposed action are expected to be minimal since the zone of turbidity around the project would be minor. Fish would be able to easily avoid the turbid areas.

(8) Land Based Life Forms.

Discharges are expected to have beneficial effects upon habitat for land based life forms by slowing the effects of erosion upon islands and associated vegetation. Protection of existing islands would promote maintenance of existing forage habitat for moose and other big game. Deposition of material behind anchored root wad logs and eco fences would provide potential for future forage growth for big game.

(9) Actions Taken to Minimize Impacts.

All work would be conducted during low-water flows in the Snake River. Low water generally occurs from October through April.

g. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination.

The current Quality Standards for Wyoming Surface Waters define a mixing zone as “a limited area or volume of a surface water body within which an effluent becomes thoroughly mixed with the water body.” In addition, the standards state that compliance with water quality standards shall be determined after allowing reasonable time for mixing. For the activities proposed in this project, the mixing zone would be assumed to extend downstream 300 feet or to a point immediately upstream of the next tributary or sub-channel confluence (where channel braids reconnect). Turbidity monitoring would be accomplished at this point unless directed otherwise by Wyoming Department of Environmental Quality (DEQ) in the 401 Certification, if issued.

(2) Determination of Compliance with Applicable Water Quality Standards and Regulations.

(a) Section 401 Certification.

Section 401 of the Clean Water Act requires that applicants requesting a Federal license or permit to conduct activities that may result in a discharge in waters of the United States, provide to the licensing or remitting agency, a certification from the State that any such discharge complies with the applicable water quality standards. This evaluation will be provided to the Wyoming DEQ for their consideration in evaluating the project for compliance under Section 401 of the Clean Water Act.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water supply.

No effect.

(b) Recreational and Commercial Fisheries.

Turbidity generated by in-water work would have only a minimal effect upon fishing activity within and downstream of the project area. Additional aquatic habitat would result almost immediately following construction of spur dikes. Long-term benefits are expected from establishment of additional habitat and improved habitat from construction of side pools, channel stabilization pools, eco fences, rock grade control, and anchored root wad logs. Additional and improved habitat would provide potential opportunity for dispersal of existing fish species and increased numbers of fish per habitat unit within the project area. Recreational fisheries are expected to experience benefits from the project.

(c) Water Related Recreation.

The discharges of dredged and fill material are expected to have beneficial, long-term impacts upon overall water-related recreational activities. The proposed project is intended to prevent further erosion of islands and loss of vegetation and to facilitate terrestrial and aquatic habitat development. Incidental benefits to sightseeing, fishing, hunting, and rafting activities should occur. Rafters may experience temporary inconveniences until they become familiar with the locations of materials discharged to build the new structures.

(d) Aesthetics.

Stockpiled gravel, screened cobble, and discharged riprap for eco fences, spur dikes, and rock grade control would contrast with the surroundings. Stockpiling of gravel and screened cobble may not occur. However, if it does, visual impacts would be temporary because the material would only be in place a short period of time. Accumulation of woody debris on the piling and rock eco fences would cause their visual contrast to be short-term. Rock grade control would be unobtrusive due to the embeddedness of the material. Contrast of the spur dikes to existing surroundings would be evident to rafters and float fishermen travelling the river and to persons visiting areas that are publicly accessible. Anchored root wad logs would blend in with the setting.

(e) Parks, National Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves.

No effect.

(f) Actions to Minimize Impacts.

A public information campaign including signage and pamphlets would be implemented to inform river users of the intended project benefits and to alert river users of the construction and presence of the completed structures.

h. Determination of Cumulative Effects on the Aquatic Ecosystem.

The physical character of the Snake River in the project area has been affected in the past by the discharge of fill to construct levees and revetments. This action caused long-term adverse effects upon the river system. The effects include reduction of the width of the floodplain, increased flow velocities through the leveed sections, increased transport of bedload material through the area and erosion of islands, and destruction of wetland and riparian vegetation. Spawning habitat for Snake River fine-spotted cutthroat trout was reduced and the composition, and quality of riparian vegetation outside of the levees continues to change due to the changes in water circulation.

During the winter of 1998-99, Teton County Natural Resource District excavated approximately 6,000 cy of cobble and gravel to construct 3 off-channel pools near the Wilson Bridge. Teton County constructed five pile eco fences, totaling approximately 500 linear feet, on the gravel bars adjacent to the river. The eco fences were placed to trap woody debris, thereby causing the deposition of sediments upon which vegetation may become established. Approximately 1,600 linear feet of channel was also excavated near the bridge to compensate for reductions in flow capacity that would result from the deposition of sediments at the eco fences. The channel capacity excavation and off-channel pool work would have caused temporary non-beneficial effects upon benthic communities, however, recolonization of disturbed areas would occur soon after the disturbance. The long-term effect of Teton County's combined actions would be improvement in water quality due to decreased erosion and improvements in aquatic and terrestrial habitat.

Environmental restoration measures being proposed under the Jackson Hole, Wyoming, Environmental Restoration Project would also have both short- and long-term effects on the aquatic environment. Construction activities would cause minor, short-term impacts to water quality with temporary disturbance of the benthos. However, presence of the completed work would reduce erosion and provide long-term benefits to water quality. Recolonization of the benthos would occur soon after completion of work.

The project would provide primary beneficial cumulative effects by enhancing previously degraded aquatic habitat and by restoring portions of previously destroyed habitat. Rock grade control would provide immediate protection against erosion of the channel bottom. Eco fences and anchored root wad logs would trap other debris and help to reduce velocities within the levied stretch. Channel stabilization pools would also reduce flow velocities and reduce the quantity of bedload material being transported through the levied stretch. Secondary channels would help disperse flows and disperse suspended sediments throughout the floodplain, and off-channel pools would provide habitat for potential spawning and rearing. Bank barbs and kickers provide protection against erosion.

The collective effect of recent actions by Teton County to restore aquatic and terrestrial habitat and those measures proposed in the Jackson Hole, Wyoming, Environmental Restoration Project would reduce the overall adverse effect that past levee and revetment work has had upon the aquatic environment. Cumulatively, the proposed action would reduce erosion of islands and loss of wetland and riparian vegetation and create circumstances for the reestablishment of vegetation.

i. Determination of Secondary Effects on the Aquatic Ecosystem.

Sediments would deposit downstream of pile fences and anchored root wad logs, providing opportunity for establishment of vegetation. Establishment of vegetation between the levees would help to slow velocities, thereby diminishing the potential for erosion. Scour areas would form around bank barbs and kickers providing resting habitat for Snake River fine-spotted cutthroat trout and other fish. No negative secondary effects are expected to result from the project.